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BIOLOGY
HIGHER LEVEL
PAPER 2

Monday 17 November 2008 (afternoon)

2 hours 15 minutes

Candidate session number

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer two questions from Section B. Write your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

0109

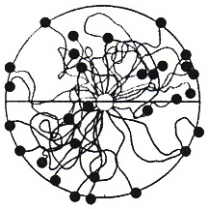
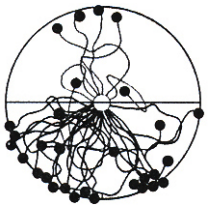
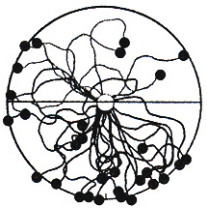
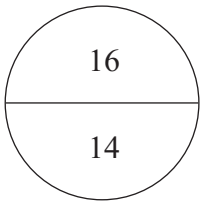
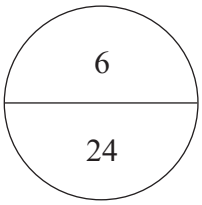
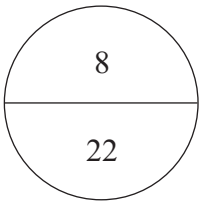
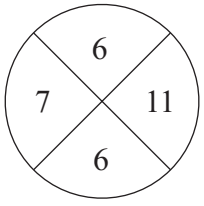
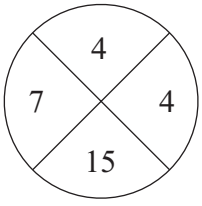
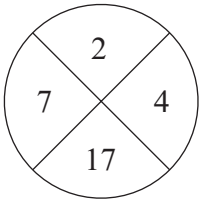
SECTION A

*Answer **all** the questions in the spaces provided.*

1. The influence of plant volatiles (airborne chemicals released by plants) on other plants was investigated using dodder (*Cuscuta pentagona*). Dodder is a vine-like weed with no leaves and little photosynthetic ability. It robs other plants of their nutrients by attaching to their shoots and leaves above ground.

In a series of experiments, 30 newly germinated dodder seedlings were placed at the centre of a damp filter paper disc. A potential target was positioned near the edge of the disc. Seedlings were allowed to grow for four days. Seedlings' growth across the disc was then recorded by tracing their location on the filter paper. Results for experiments are shown in the diagrams below. The black dots represent the final positions to which the seedlings grew.

Figure 1: Filter paper showing results of dodder seedling growth responses

	Filter paper results		
	Experiment 1	**Experiment 2**	**Experiment 3**
Target	moist soil	20-day-old tomato plant	cotton saturated with tomato volatiles
Tracings of seedling growth responses			
Target Position	×	×	×
Tracing counts of disc halves			
Tracing counts of disc quarters			

[Adapted from Runyon et al, "Volatile Chemical Cues Guide Host Location and Host Selection by Parasitic Plants", Science, vol. 313, issue 5795, pages 1965-7. Reprinted with permission from AAAS.]

(This question continues on the following page)

(Question 1 continued)

(a) (i) Calculate the percentage of seedlings that grew towards the target in experiment 1 and in experiment 2. *[1]*

Experiment 1: . . . . . .

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Experiment 2: . . . . . .

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(ii) Compare the results of experiments 1 and 2. *[2]*

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(b) State the purpose of experiment 1. *[1]*

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(Question 1 continued)

Table 1: Shows a summary of results for experiments 1, 2 and 3 and for four additional experiments that were carried out

		Growth of seedlings towards disc half	
Experiment	**Target**	**with target**	**without target**
1	Moist soil	14	16
2	20-day-old tomato plants	24	6
3	Cotton saturated with tomato volatiles	22	8
4	10-day-old tomato plants	23	7
5	Artificial tomato plants	12	18
6	Red container	14	16
7	Green container	12	18

[Adapted from Runyon et al, "Volatile Chemical Cues Guide Host Location and Host Selection by Parasitic Plants", Science, vol. 313, issue 5795, pages 1965-7. Reprinted with permission from AAAS.]

(c) Analyse the results shown in **table 1**. *[3]*

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A chi-squared test was performed on the above results.

(d) (i) Predict the expected distribution of seedling growth in the disc halves. *[1]*

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(ii) Suggest reasons for performing this test. *[1]*

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(Question 1 continued)

(e) Discuss the use of disc quarters when processing the results. *[2]*

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(Question 1 continued)

Scientists then compared the growth response of dodder to the volatile compounds extracted from tomato plants with those extracted from wheat plants (*Triticum aestivum*). The results for these tests are shown in the summary table below.

Table 2:

		Growth of seedlings towards disc half	
	Volatile compound	**with volatile**	**without volatile**
Tomato plants	Pinene	20	10
	Phellandrene	21	9
	Limonene	16	14
Wheat plants	Hexenyl acetate	9	21
	Decanal	21	9
	Nonanal	15	15

[Adapted from Runyon et al, "Volatile Chemical Cues Guide Host Location and Host Selection by Parasitic Plants", Science, vol. 313, issue 5795, pages 1965-7. Reprinted with permission from AAAS.]

(f) (i) Analyse the relative attraction of dodder seedlings to tomato plants and to wheat plants. *[3]*

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(ii) Predict **one** practical use for hexenyl acetate. *[1]*

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(iii) Suggest the importance of plant volatiles. *[2]*

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(Question 1 continued)

(g) Suggest **one** area of further research into the response of a plant that is being stimulated by volatiles from another plant. *[1]*

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2. (a) Define the term *degenerate* in relation to the genetic code. *[1]*

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(b) Compare competitive inhibition and non-competitive inhibition. *[2]*

Competitive inhibition	Non-competitive inhibition

(c) State the phase in meiosis when crossing-over occurs. *[1]*

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(d) Identify the recombinants in a test cross of $\frac{TB}{tb}$. *[2]*

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3. (a) Outline the movement of ions across the membrane during the passage of a nerve impulse along a non-myelinated neuron. *[2]*

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(b) Explain how the loop of Henle assists in osmoregulation. *[3]*

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(c) Describe the function of oxygen in oxidative phosphorylation. *[2]*

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(d) State **one** reason why blood clotting is a form of defence. *[1]*

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SECTION B

*Answer **two** questions. Up to two additional marks are available for the construction of your answers. Write your answers on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.*

4. (a) Draw and label the detailed internal structure of the ovary. *[4]*

(b) Describe the process of fertilization. *[6]*

(c) Explain the process of transcription in eukaryotes. *[8]*

5. (a) List **one** example of a disease caused by **each** of the following:

- fungi
- protozoa
- flatworms
- roundworms. *[4]*

(b) Describe antibody production. *[8]*

(c) Using MMR vaccine as an example, discuss the benefits and dangers of vaccination against bacterial and viral infection. *[6]*

6. (a) List **four** functions of proteins giving a **named** example of each. *[4]*

(b) Outline the structure of ribosomes. *[6]*

(c) Explain the function of vesicles in eukaryotic cells. *[8]*

7. (a) Draw and label the structure of a chloroplast as seen in electron micrographs. *[4]*

(b) Explain the light-independent reactions. *[8]*

(c) Outline how xerophytes and hydrophytes are adapted to their different environments. *[6]*